PATENT SPECIFICATION

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(54) IMPROVEMENTS RELATING TO BALL JOINTS

(71) We, SAITAMAKIKI CO., LTD. a corporation organised uner the Laws of Japan, of 650, Shimoochiai, Yono-City, Saitama-Prefecture, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a shock absorbing ball joint in a torque rod, for use in automobiles.

Heretofore, a ball joint has generally been used for a torque rod interposed between the wheel axle of a heavy vehicle having a double-axle rear wheel arangement, and the chassis thereof thereby to automatically adjust to the movement of the wheel axle relative to the chassis while the vehicle is running on rough or uneven roads. In this case, however, the bearing housing supporting the spherical portion of the ball joint, is connected directly to the torque rod. Accordingly, when a strong impulsive force is instantaneously imparted to the wheel, the wheel axle and the torque rod e.g. at the time of braking, the conventional ball joint takes the complete shock, the shock acting directly on the spherical-ended shaft and bearing block. This results in damage or a large degree of wear on the spherical portion of the shaft, the bearing block and/or torque rod, and also damage to the brakes.

According to the present invention there is provided a shock absorbing ball joint in a torque rod, for use in automobiles, comprising a shaft having a spherical shaped ball portion located in a bearing block in a bearing housing, a check ring, holding the bearing block in said housing, an annular elastic band being fixed to the outer periphery of said bearing housing and a cylindrical shell being fixed to the outer periphery of said band, the exposed end surfaces of the elastic band being recessed, the recesses having the form of a parabola, and the shell being press fitted into a boss on the torque rod, the shell together with the elastic band and the bearing housing forming a unitary construction.

The present invention provides a shock absorbing ball joint wherein an elastic band made of a strong elastic substance such as rubber, or a synthetic resin etc. is interposed between the bearing housing and the torque rod thereby to eliminate the aforementioned defects. However, the load which the elastic band receives by said impulsive force is much larger than the ordinary vibrating load of anti-vibration rubber, and therefore the deformation induced by the load in this case is remarkably large. Accordingly, when elastic bands of the conventional shape are used, the end exposed surfaces of the elastic band upon swelling due to the load compression, rub with the housing portions to generate cracks in the elastic band resulting in damage to the ball joint. The aforementioned drawbacks are eliminated by the forming of the exposed end or side surfaces of said elastic band into a parabolic shape, i.e. a deeply recessed shape.

The shock absorbing ball joint in the torque rod of the present invention is simple in its construction and can be easily produced and is capable of being used for a long period of time without being supplied with any further oil.

The present invention well now be further described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a cross-sectional elevation of one embodiment of a ball joint in a torque rod constructed according to the present invention;

Fig. 2 is a side elevation showing part of an automobile rear double axle arrangement including ball joint and torque rod arrangements as per Fig. 1;

Fig. 3 is a cross-sectional elevation of a ball joint showing the second example em-

bodying the present invention; and

Fig. 4 is a diagram, on an enlarged scale, showing a part of the ball joint shown in Fig. 3.

In Fig. 1 illustrating one embodiment of a ball joint constructed in accordance with the present invention, reference numeral 6 designates a shaft having a spherical end or ball portion, bearing block 7 in a bearing housing 9 being located around this spherical end. An elastic band 8 is arranged around the bearing housing 9 and is encased in a cylindrical shell 10 which is located as per a bush in a boss in torque rod 11. A check ring 12 is located in the open end of the bearing housing 9, as can be seen in Fig. 1, and engages behind a flange to retain the bearing block 7 in the housing 9. The bearing housing 9 is closed at its open end by an annular shaped dust cover 13 of resilient material such as rubber, which surrounds the shank of the spherical-ended shaft 6.

A bracket 16 is fitted to the chassis 15 (Fig. 2) through a plate spring 19, and brackets 16' on the wheel axles 18 support the load of the chassis through the plate spring 19, the brackets 16 and 16' being connected to each other by torque rods 11.

The torque rods 11 are attached at their ends to bracket 16 or brackets 16' by the spherical-ended shaft 6 as illustrated in Fig. 1. The spherical bearing block 7 is formed from two parts which are made of a sintered alloy or a special reinforced plastics material. Said bearing block 7 is inserted in the bearing housing 9 and retained by the check ring 12 so that it does not fall out. A lubricating material 20 such as oil or grease is filled in the ends of said bearing housing, the leakage of oil being prevented by the dust cover 13. A steel cover support ring 14 having an L-shaped cross-section, is fixed to the outer periphery of the dust cover 13 by fusing or the like, the dust cover 13, for example, as shown in Fig. 4, being held in the housing by pressing the support ring 14 into a hole in the housing 9, which increases in diameter inwardly of the housing. The elastic band 8 formed by an elastic substance such as rubber or a reinforced synthetic resin or the like, is fixed to the outer periphery of the bearing housing 9 by fusing or bonding. Further, the shell 10 made of steel is fixed to the outer periphery of said elastic band 8 by fusing or bonding in the same manner as above. Thus, said shell 10, elastic band 8 and bearing housing 9 are integrally interconnected. In an alternative construction the shell 10 may be made of any suitable rigid material. Said shell 10 is press-fitted and fixed in a boss of the torque rod 11. Since said elastic band 8, as shown in Fig. 1, has its exposed side or end surfaces deeply recessed parabolically, these surfaces do not come into contact with the ends of shell 10 or the end of the bearing housing 9 upon the band 8 swelling in the region of these exposed surfaces due to the compressive force of a high load. Thus, damage to these exposed surfaces by rubbing against the shell or bearing housing, is prevented.

Considering the first embodiment of the present invention as illustrated in Figs. 1 and 2 and described hereabove, the impulsive force transmitted from wheel 17 to the torque rod 11 through bracket 16', or the impulsive force transmitted to the torque rod 11 through bracket 16 is absorbed by the elastic band 8. Accordingly, the impulsive force is not directly applied to the spherical end bearing block 7 and the spherically ended shaft 6, and therefore any damage or any wear thereof can be prevented and the life of the ball joint portion can be prolonged. As has been mentioned in the foregoing, by the exposed surfaces of elastic band 8 being formed so that they are recesses of parabolic shape (for example, recesses more than $\frac{1}{4}$ of the radial thickness in depth) the wear and damage due to the contact of the exposed surfaces of the elastic band with other parts, is prevented.

In Figs. 3 and 4 of the accompanying drawings illustrating a second embodiment of the present invention, a shaft 26 has a centrally located spherical ball portion which is supported in a bearing block 27. The bearing block 27 is arranged in a bearing housing 29 which is open at opposite ends, the ends of the shaft 26 extending through the open ends of the housing. The housing 29 is surrounded by an elastic band 28 which is itself surrounded by a cylindrical shell 30, the shell 30 being fitted in a boss on a torque rod 31. Towards one open end of the housing is a guide wall 35 which retains the spherical bearing block 27 in the housing. In the region of the other open end of the housing, a small flange is provided behind which a check ring 32 engages to also retain the bearing block 27 in the housing. Dust covers 33 of resilient material are provided at each open end and ring-shaped covers 34 as per Fig. 4, retain the dust covers in position in the same manner as the cover support rings 14 in Fig. 1.

While the first embodiment is provided with a shaft having a spherical end portion for one-sided support, the second embodiment has a shaft 26 which has a central spherical portion, the ends of the shaft being both supported by brackets. More specifically, the brackets fitted to the chassis (not shown) and the bracket on the wheel axle supporting the load of the chassis through the plate spring are connected to each other by means of the torque rod 31

The shaft 26 both ends of which are supported by either of both brackets, is fitted and supported by the spherical end bearing block 27 which is in two parts made of a combination of a reinforced plastics material such as Drelin (Trade Mark) and an oil-containing textile material. Said bearing block 27 is inserted in the bearing housing 29 having a guide wall 35 and retained by a check ring 32 so that it does not fall out. Lubricating material 36 such as oil or grease, or the like is filled in the end parts of the housing beyond guide wall 35 and check ring 32 and covered by dust covers 33. Each dust cover 33 is provided with a steel cover support ring 34 having an L-shaped cross-section and being fused or bonded to the dust cover 33. As shown in Fig. 4 by thrusting the cover support ring 34 into a recess which has a diameter which increases inwardly of the bearing housing 29 the dust cover is mounted thereon. The elastic band 28 formed from an elastic material such as rubber, a reinforced synthetic resin or the like is fixed by fusion or bonding around the outer periphery of the bearing housing 29. The shell 30 made of steel or some other suitable material is fixed to the outer periphery of said elastic band 28 by fusion or bonding. Thus said shell 30, elastic band 28 and bearing housing 29 form an integral construction. Said shell 30 is press-fitted and fixed in the boss of the torque rod 31. Said elastic band 28, has its exposed surfaces deeply recessed parabolically in the same manner as the first embodiment. Thus, its exposed surfaces do not come into contact with the ends of the shell 30 or the end portion of the metal bearing housing 29 even when said elastic band swells out when undergoing a compressive force due to a high load, and hence any damage due to such wear is prevented.

In the second embodiment of the present invention having the aforementioned construction, the central portion of the spherical bearing block 27 which directly receives the spherical portion of shaft 26, is made from an acetal resin plastics material such as Delrin or the like. Thus, the bearing has a great durability as compared with a conventional metal-made bearing. Further, an oil-containing textile material is used on both end parts of bearing block 27 and a lubricating material 36 such as oil or grease, or the like is filled in the end parts of the bearing housing between the guide wall 35 and adjacent open end of the housing and the check ring 32 and adjacent open end of the housing. The oil or grease is held in the housing by dust covers 33. Accordingly, the smooth rotation of the spherical portion of shaft 26 in the bearing block 27 can be retained for a long period of time without supplying oil, the ingress of water and dust and the leakage of lubricating material 36 being discouraged by the dust covers 33 mounted on both openings of the bearing housing 29. Even if dust or the like gains entry to the inside of dust cover 33, it will be absorbed by the lubricating material 36 or oil-containing textile material and will not reach the central portion of the bearing block 27. Hence no damage will be caused to the spherical ball portion of shaft 26. Further, as mentioned above, since the elastic band 28 is deeply recessed parabolically (e.g. recesses are more than $\frac{1}{4}$ of the thickness of the band, in depth) at the exposed end surfaces, even when said elastic band swells or bulges out beyond the ends of cylindrical shell 30 when undergoing a compressive force due to a high load, its exposed end surfaces will not come into contact with the end of shell 30 or the end of the bearing housing 29, and hence any damage caused by wear is prevented. As the total result of these features, the smooth operation of the ball joint in the torque rod and the durability thereof are greatly improved.

In the foregoing, the present invention has been explained with reference to a few examples. However, in the present invention other examples are possible. It should be understood that a number of modifications may be possible without departing from the scope of the present invention as defined in the appended claims.

WHAT WE CLAIM IS:—

1. A shock absorbing ball joint in a torque rod, for use in automobiles, comprising a shaft having a spherically shaped ball portion located in a bearing block in a bearing housing, a check ring, holding the bearing block in said housing, and annular elastic band being fixed to the outer periphery of said bearing housing and a cylindrical shell being fixed to the outer periphery of said band, the exposed end surfaces of the elastic band being recessed, the recesses having the form of a parabola, and the shell being press fitted into a boss on the torque rod, the the shell together with the elastic band and the bearing housing forming a unitary construction.

2. A shock absorbing ball joint in a torque rod, as claimed in claim 1, in which the elastic band is formed of rubber.

3. A shock absorbing ball joint in a torque rod, as claimed in claim 1 or 2, in which the elastic band is fused or bonded to the outer periphery of the bearing housing and to the shell.

4. A shock absorbing ball joint in a torque rod, as claimed in any one of claims 1 to 3, in which the depth of each recess is more than half of the thickness of the elastic band.

5. A shock absorbing ball joint in a torque rod, as claimed in any one of the preceding claims, in which an annular dust cover is located over the shaft, the outer peripheral edge of the cover having a cover support ring attached thereto, by means of which the outer edge of the dust cover is fixed in an opening in the bearing housing, the diameter of the opening increasing inwardly of the housing.

6. A shock absorbing ball joint in a torque rod, as claimed in claim 5, in which the dust cover is made from a resilient material e.g. rubber.

7. A shock absorbing ball joint in a torque rod, as claimed in claim 5, or 6, in which lubricating oil or grease fills the bearing housing around the said ball portion, and is retained therein by the dust cover.

8. A shock absorbing ball joint in a torque rod, as claimed in any one of the preceding claims, in which the bearing block is formed from a combination of an acetal resin plastics material and includes an oil-containing fabric at both its ends.

9. A shock absorbing ball joint in a torque rod, as claimed in any one of the preceding claims, in which the spherical ball portion is at one end of the shaft, the bearing housing having one opening through which the shaft projects

10. A shock absorbing ball joint in a torque rod, as claimed in any one of claims 1 to 8, in which the spherical ball portion is substantially in the middle of the length of the shaft, the ends of the shaft projecting through two openings in the bearing housing.

11. A shock absorbing ball joint in a torque rod, as claimed in any one of the preceding claims, in which the shaft is connected to a bracket projecting from the chassis of the automobile and the shaft of a further ball joint provided on the torque rod, is connected to a bracket projecting from a wheel supporting member.

12. A shock absorbing ball joint in a torque rod, for use in automobiles, constructed and arranged substantially as hereinbefore described with reference to and as illustrated in Figs, 1, 2 and 4 or Figs. 2, 3 and 4 of the accompanying drawings.

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2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

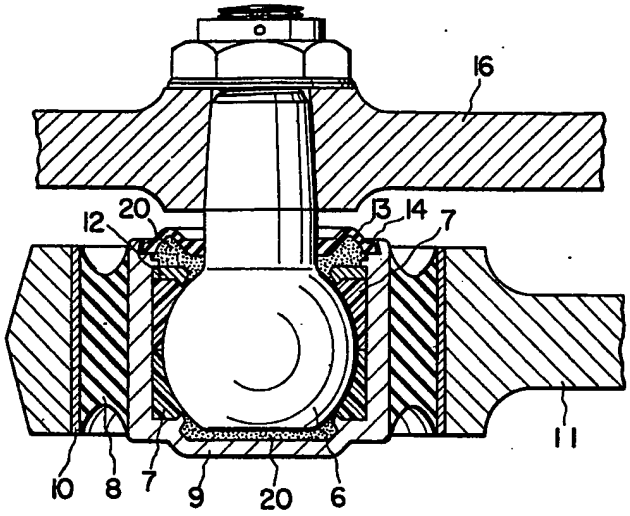


FIG. 2

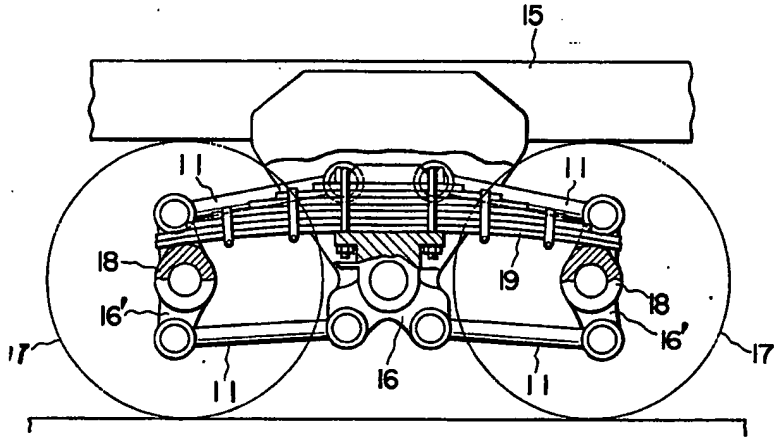


FIG. 3

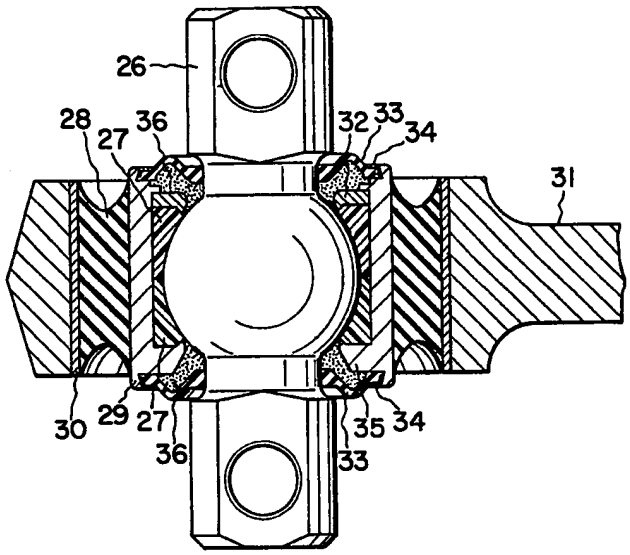
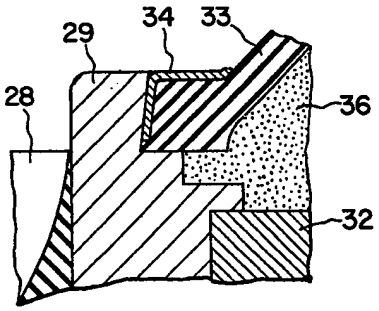


FIG. 4



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